DEVELOPMENT OF THE RESOURCES

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PROSPECTS OF DEVELOPING OBSKII ALLUVIAL AND WATERSHED SANDS IN WEST SIBERIA

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Quartz sand samples from alluvial deposits in Khanty-Mansiiskii Autonomous District are studied. It is proposed to build a concentration enterprise using the principles of integrated processing of initial loose masses.

Siberia possesses substantial natural resources for construction materials; however, their active use is impeded by the lack of an integrated processing concept and a poorly developed building industry. Bringing together the raw material resources and the sites of their consumption is the way to reduce the cost of material transportation.

Samples of quartz sand from three alluvial deposits (Pakochi, Kar'er, and Gidronamyv) were studied in order to investigate the possibility of their application in glass production. Figure 1 represents the granulometric composition of the investigated sands. It can be seen that the sand from the Pakochi deposit is fine-grained. The content of the main sand fraction (0.1 – 0.5 mm) is about 97%, which satisfies the requirements of GOST 22551. The quartz sands from the Kar'er and Gidronamyv deposits are medium-grained. The main fraction content in these sands is 88 and 76%, respectively. The sand samples satisfy the specified standard by their content of large particles, and as for their content of fine particles (below 0.1 mm), the sample from the Kar'er deposit satisfies the above standard (12%), and the Gidronamyv sample does not (22%).

Table 1 presents the chemical compositions of the samples. The natural (initial) sands from the Pakochi and Kar'er deposits correspond to grade PS-250 (GOST 22551) and are suitable for the production of foam glass, fiberglass for building purposes, food jars and semiwhite glass bottles, insulators, pipes, and storage jars. The Gidronamyv sand does not satisfy the requirement of GOST 22551 due to its low SiO_2 content and the high content of Al_2O_3, Fe_2O_3, TiO_2.

By their mineral composition, Pakochi and Kar'er deposits contain quartz sand, and Gidronamyv contains quartz-feldspar sand. All samples contain heavy minerals with specific weight over 2.9 g/cm^3: ilmenite, garnet, stavrolite, pyroxene, tourmaline, sphene, zircon, ferrous quartz with inclusions, kyanite, epidote, and leucoxene. Of special interest are zircon and titanium-bearing minerals. The heavy fraction contents in the sand from Pakochi and Kar'er deposits are 0.359 and 0.229%, respectively, and in Gidronamyv sand it is 1.455%.

In order to determine the possibilities of concentrating the investigated sands, the VNIPIIstromsyr'e State Enterprise carried out an express study consisting of consecutive removal of the main impurities contaminating the initial quartz material: argillaceous particles and clay paste on the quartz grain surface, individual ore and non-ore heavy fraction minerals with specific weight over 2.9 g/cm^3, as well as iron hydroxide film which coats quartz grains.

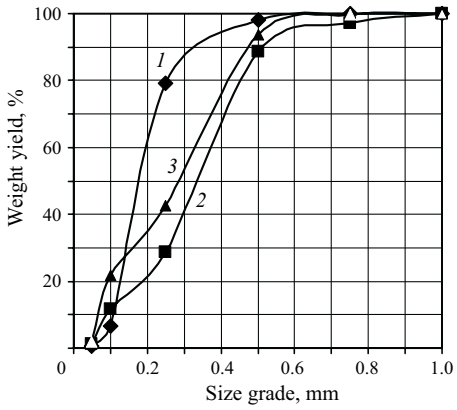

Fig. 1. Granulometric composition of quartz sand from Pakochi (*1*), Kar'er (*2*), and Gidronamyv (*3*) deposits.

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Table 2 shows the results of the express analysis of Fe_2O_3 distribution among the impurity groups. The quality of the obtained concentration products was controlled by testing the ferric oxide content in accordance with GOST 22552.5

TABLE 1

Deposit	Weight content, %								
	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	K_2O	Na_2O	calcination loss
Pakochi	97.50	0.98	0.23	0.08	0.08	0.05	0.25	0.20	0.63
Kar'er	96.86	0.87	0.17	0.09	0.10	0.28	0.29	0.83	0.51
Gidronamyv	87.16	6.27	0.98	0.30	0.72	0.36	1.47	0.91	1.83

All the considered sand samples are contaminated by three main types of impurities. However, their distribution in the samples is different. Thus, in samples of the Pakochi and Kar'er deposits, the main contaminating impurities are heavy minerals and ferric hydroxide film, which upon removal can yield 77.77 and 67.05% Fe_2O_3, respectively.

The initial material of the Gidronamyv deposit is contaminated by three main types of impurities: 23.22% Fe_2O_3 can be extracted upon removing the argillaceous component, 35.26% Fe_2O_3 can be extracted on removing heavy minerals, and 30.34% Fe_2O_3 – upon removing the film. The relatively high residual content of iron oxides in this sand sample is presumably related to the insufficient removal of the feldspar component from the raw material.

All samples after concentration can be used as quartz concentrates suitable for glass melting. The initial raw materials from the Pakochi and Kar'er deposits can be used for quartz concentrate corresponding to grade VS-050-1, suitable for the production of window and technical sheet glass, laboratory, medical, and perfume glass, glass fiber for electrical engineering, illumination equipment, sodium silicates (catalysts), rolled stock, glass blocks and profiling, food jars and bottles of decolorized glass, car windows, and plate glass.

The quartz-feldspar sand from the Gidronamyv deposit can be used to produce quartz concentrate corresponding to grade PB-150-2, which is suitable for glass fiber for construction purposes, food jars and bottles of semiwhite glass, insulators, pipes, and storage jars. A more detailed study of the concentration potential of the Gidronamyv sand will probably make it possible to obtain a better quality concentrate.

Thus, in developing the concentration technology for sands of the specified deposits, it is necessary to provide for integrated processing of initial loose masses, so that the end products include not only quality standard materials, i.e., concentrated quartz sand for glass production according to GOST 22552, molding sand according to GOST 2138, and building sand to be used as the filling agent in concrete and building mixtures according to GOST 8736, but ore minerals as well, namely, zircon and titanium, which are in demand both in Russia and abroad. The implementation of this technology will make it possible to substantially improve the economic parameters of the production companies, for instance, increase their profitability, reduce the repayment period down to 1.5 – 2 years, etc.

TABLE 2

Deposit	Material	Yield, %	Fe_2O_3 content, %	Fe_2O_3 extraction, % of initial content
Pakochi	Argillaceous fraction	0.86	1.383	5.17
	Heavy fraction	0.30	40.099	51.85
	Ferric hydroxide film	0.80	7.540	25.92
	Quartz concentrate	98.04	0.040	17.06
	Initial	100.00	0.230	100.00
Kar'er	Argillaceous fraction	0.40	2.661	6.26
	Heavy fraction	0.36	16.770	35.36
	Ferric hydroxide film	0.60	9.047	31.69
	Quartz concentrate	98.64	0.046	26.69
	Initial	100.00	0.170	100.00
Gidronamyv	Argillaceous fraction	2.28	9.981	23.22
	Heavy fraction	3.18	11.120	35.26
	Ferric hydroxide film	2.10	14.880	30.18
	Quartz concentrate	92.44	0.120	11.34
	Initial	100.00	0.980	100.00

Setting up a concentration enterprise based on the principles of integrated processing of primary loose masses in Khanty-Mansiiskii Autonomous District, for instance, in the town of Megion, will make it possible to solve the problem of complete processing of raw material, including substandard materials which can be used for filling roadbeds, dykes, and other structures.

If the concentrated quartz sand will be used for glass production in the same district, it will be possible to significantly decrease the production cost of glass articles and make them competitive on the glass market, in spite of the fact that some materials, in particular, soda ash, have to be brought from other regions.

The complete implementation of this program will provide jobs for over 1000 people, mostly unskilled local residents, and will create opportunities for further economic development of the town and the adjacent region through setting up small handicraft production companies which will use the products of processing raw materials.